

HUMAN CAPITAL: A
REVIEW OF THE LITERATURE

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CHAPTER I

INTRODUCTION

This paper is aimed at surveying the literature on human capital.¹ From this it is hoped that the reader will have a better perspective from which he can evaluate the literature that is now being written on the subject. To achieve this the paper is divided into three major parts: (1) There is a historical chapter to give a background for studying the recent literature. (2) The next chapter surveys the recent literature. (3) The last chapter summarizes the major ideas presented.

The historical chapter first traces the development of the theoretical interest in human capital. Second, it traces the empirical techniques developed for use in studies on the magnitude and on the rate of return from investments in human capital. Finally, it presents a few examples of the type of empirical studies that were done in this early period.

The third chapter on recent interest in human capital, is divided into three parts. It first analyzes why interest had temporarily declined and why there is value in reviving this interest. In the second section, we see how human capital has been put into a theoretical analysis. Then in the third section

¹The use of the term "human capital" in this paper will refer to the stock of capital invested in man to increase his efficiency. This investment can come in many forms such as education, health, and migration.

we look at some of the empirical studies done in recent years. These studies are limited to three areas of human capital: general education, technical education, and health. In each of these areas some attempt is made to estimate the magnitude of the investment stock and to estimate the rates of return from these investments.

The last chapter is a summary of the paper. The purpose here is to re-emphasize some of the major points made in this paper and in particular those points made in Chapter III.

CHAPTER II

HISTORICAL CONSIDERATIONS OF HUMAN CAPITAL

Introduction

The interest in investment in human capital, which has become so extensive since Theodore W. Shultz presented his first article on investment in man in the *Social Science Review* in 1959,¹ can be traced back to the Classical economists or even to the Mercantilists before them. Economists such as Petty (1691), Smith (1776), Mill (1848), Walras (1874), and Marshall (1890) gave consideration to investment in the discussions of wealth, capital, and investment. These men contributed much to the formulation of the present theory of investment in human capital. Also, the empirical approaches that are so much a part of our present literature had their beginnings in this earlier period.

The intent of this chapter is to survey the developments from the time of Sir William Petty up to the early 1930's. This chapter will have two major emphases. It will first consider the advance of the theoretical concepts concerning investment in human capital. This will give us a background from which to evaluate the more recent work that is being done on investment in human capital. The second area to be studied in this chapter

¹Theodore W. Schultz, "Investment In Man: An Economist's View," The Social Service Review, Vol. 33, (June, 1959).

is some of the empirical techniques and applications of theory that were attempted prior to the mid-thirties. This will give an insight into the problems that are to be faced and some of the various methods that can be used for investigating investment in human capital.

Early Theoretical Contributions

Adam Smith

The theoretical considerations of investment in human capital go back at least as far as Adam Smith² and The Wealth of Nations, written in 1776. In this book Smith considered the importance of human skill and ability in determining the wealth of nations. Although he did not make any estimate of the total value of man as a factor of production, he realized that the value of education and skills were reflected in the wage scale. "The wages of labor vary with the easiness and cheapness, or the difficulty and expense of learning the business."³

In fact, according to Smith, the additional wages paid for these important skills tended to yield a rate of profit on their investment equal in value to that on capital.

²We shall see later that statistical estimates of the wealth of human beings goes back as far as Sir William Petty.

³Adam Smith, The Wealth of Nations, (New York: Random House, 1950), p. 101.

A man educated at the expense of much labor and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profits of an equally valuable capital.⁴

The similar economic characteristics of education and investment in capital goods were brought out in many phases of Smith's writing. He observed that not only were there expenditure costs of education that should be considered as investment in capital, but there were also opportunity costs that had to be so considered.

The acquisition of . . . talents, by the maintenance of the acquirer during his education, study or apprenticeship, always costs a real expence, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise of that of the society to which he belongs. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labor, and which, though it costs a certain expence, repays that expence with a profit.⁵

Besides these key considerations of investment in human capital, Smith also made other points that were picked up at length by some of the economists who followed him.

First of all he noted that not all education can equally be considered investment. In fact he encouraged basic education to cover geometry and mechanics rather than Latin as they served a useful purpose in the economic world.

⁴Ibid., p. 101.

⁵Ibid., pp. 265-266.

Second, the benefits of education were not limited to the economic spectrum. The whole moral and social development of an individual rested on a sharp mind. In this regard Smith thought that education could counteract the tendency of specialization which Smith thought tended to dull the worker's mind.

Finally, he realized that there are externalities to the benefits of education that the individual and his family could not reap. This leads to the issue of proper division of the investment expenditure between the individual and the state.

The expence of the institutions for education and religious institutions is likewise, no doubt, beneficial to the whole society, and may, therefore, without injustice be defrayed by general contribution of the whole society.⁶

McGulloch

Writing fifty years after Smith, J. R. McGulloch presented a view of human capital that was different from Smith's. In contrast with the view that only the developed skills of labor should be considered as capital, McGulloch felt man himself should be considered as capital. After all, man is as much a product of labor as any machine. So,

Instead of understanding by capital all that portion of the produce of industry extrinsic to man, which may be made applicable to his support, and to the facilitating of production, there does not seem to be

⁶Ibid., p. 768.

any good reason why man himself should not, and very many why he should be considered as forming a part of the national capital."⁸

To estimate the expenditure or investment in humans, McCulloch recommended summing the living expenses for the first twenty years, i.e. maturity, plus any special training expenditures.

Fisher and Walras

Fisher and Walras also considered the whole human being in their concepts of capital. Fisher stated that; "the skill of a mechanic is not wealth in addition to the man himself; it is the skilled mechanic who should be put in the category of wealth."⁹ By capital Fisher meant a stock of wealth existing at a point in time. Walras defined capital as all durable goods, all forms of social wealth which are not used up or are used only with the lapse of time. Accordingly, "we see that land, persons, and capital proper constitute capital."¹⁰

The consideration of man as capital or for that matter investment had moral implications that bothered some individuals. They argued that the productive process was for man; it was not an end in itself for which man was only one of the factors of

⁸B. F. Kiker, "The Historical Roots of the Concept of Human Capital," Journal of Political Economy, (Oct, 1966) p. 486.

⁹Irving Fisher, The Nature of Capital and Income, (London: Macmillan and Co., 1906) p. 9.

¹⁰ Leon Walras, Elements of Pure Economics, (London: George Allen and Unwin Ltd., 1954) p. 215.

production. Walras presented his defense of the concept of human capital in the following passage:

In speaking of persons as natural capital and as reproducing themselves by procreation, we are not overlooking the principle of social ethics which is gaining ever wider acceptance; that persons should not be bought and sold like things, nor bred in barnyards or stud-farms like cattle or horses. It might be thought beside the mark, therefore, to include persons in a theory of the determination of prices. On the other hand, although personal capital is not subject to purchase and sale, labour or personal capital are offered and demanded every day on the market, so that personal capital can, and often should, at least be evaluated.¹¹

Von Thunen

This defense of the concept of human capital was preceded years earlier by Von Thunen in his book on The Isolated State. In it he stated:

Hitherto the promotion of material prosperity has often seemed to conflict with the other ends of state; and it is generally accepted that prosperity -- the possession of material goods -- must be subordinate to moral welfare.¹²

But in maximizing the natural wage Von Thunen said that:

moral and material welfare, are no longer incompatible, . . . (it) is possible only where the people have attained a high level of intellectual and moral education.

If we regard the capital spent on working class education as part of national wealth, because it is repaid, at ample employment of children, which is detrimental to their schooling is not merely reprehensible

¹¹ Ibid., p. 216.

¹² Johann Heinrich Von Thunen, Von Thunen's Isolated State, (London: Pergamon Press, 1966) p. 273

from the moral but also from the economic point of view.¹³

He felt as did the classical economists that the treatment of human capital in an analytical framework did not deny any of the humanity of man; on the other hand, it could help improve not only the material welfare but also the moral welfare..

Mill

John Stuart Mill did not even consider the possibility of divergent moral and economic values worthy of consideration in his Principles of Economics. Here he elaborated in Chapter 14 on the differences in wages, on the treatment that Adam Smith had given investment in human capital.

Some employments require a much longer time to learn and a much more expensive course of instruction than others; and to this extent there is . . . an inherent reason for their being more highly remunerated.¹⁴

In fact,

his wages . . . must yield, over and above the ordinary amount, an annuity sufficient to repay these sums, with the common rate of profit, within the number of years he can expect to live and be in working condition.¹⁵

Mill goes on to state that the above difference in wages between skilled and unskilled is the lowest that can last for any length of time, since otherwise no one would learn the skilled

¹³Ibid., p. 216.

¹⁴John Stewart Mill, Principles of Political Economy, Vol. I, (New York: D. Appleton and Co., 1909) p. 478.

¹⁵Ibid., pp. 478-479.

employments.¹⁶

Mill also noted that the return in wages for skilled labor over unskilled would tend to exceed the required difference because of a natural monopoly. That is, many of the unskilled labors could not compete for skilled positions because they would not afford to forgo their present income no matter how high the return might be. This limitation on competition was breaking down over time, he admitted, but was still a significant factor.

Sidgwick

Sidgwick added to the advance made by Mill when he made clear the distinction between consumption expenditures made to increase labor's productivity.

It is only so far as the laborer's consumption is distinctly designed to increase his efficiency, that it can properly be regarded as an investment of capital But generally speaking, we must, I think, regard the consumption of produce, for the preservation or enjoyment of life, as the final end of the series of changes that make up the process of production; and accordingly must distinguish it broadly from consumption that would not be incurred, except as a means to further production; treating as a gift of nature any undesigned gain in productive efficiency that might result from its.¹⁷

¹⁶This statement is incomplete without other comments Mill made in his chapter on the differences in wages. He also stated that not only are the expected pecuniary rewards to be considered but also the nature of the work, the social prestige, and dedication to a field influence the choice of one's occupation.

¹⁷Henry Sidgwick, The Principles of Political Economy, (London: Macmillan and Co., 1901), p. 134.

Sidgwick by this analysis indicates a separation between labor and capital. Contrary to McCulloch and Walras, not the whole man is considered as capital or even his normal abilities. It is only those intentionally developed for added productivity that can be considered capital. The word "intentionally" in the above sentence is very important for it denotes that only those expenditures planned to improve efficiency are to be considered as capital.

This view differs from the present view which is any investment that increases productivity of labor above its native state is to be considered investment in human capital. For example, in determining the investment for education, one includes not only those expenditures that are made for pure investment reasons but also part of the expenditures made on consumption if these expenditures have as a by-product increased the student's efficiency. The problem then becomes trying to estimate how much should be really considered investment and how much should be considered consumption.

Marshall

Marshall, like these economists who went before him, was aware of the benefits of education.

Marshall in his Principles of Economics went to great lengths to show the importance of education.

Little need be said of general education; though the influence even of that on industrial efficiency is greater than it appears. . . . But the advance made

at school is important not so much on its own account, as for the power of future advance which a school education gives. For a truly liberal general education adapts the mind to use its best faculties in business and to use business itself as a means of increasing culture; though it does not concern itself with the details of particular trades: that is left for technical education.¹⁸

He saw that

a good education confers great indirect benefits even on the ordinary workman. It stimulates his mental activity It is an important means towards the production of material wealth; at the same time, regarded as an end in itself, it is inferior to none of those which the production of material wealth can be made to subserve.¹⁹

In fact, he felt, no change would induce so rapid a rise in material wealth as education of the clever working men's children to the limit of ability.

We may then conclude that the wisdom of expending public and private funds on education is not to be measured by its direct fruits alone. It will be profitable as a mere investment, to give the masses of the people much greater opportunities than they can generally avail themselves of. For by this means many, who would have died unknown are enabled to get the start needed for bringing out their latent abilities. And the economic value of one industrial genius is sufficient to cover the expenses of education of a whole town.²⁰

Not only is education of value from a business viewpoint, it is also of great social value. Therefore, optimizing the investment in education as one would optimize the return on

¹⁸Alfred Marshall, Principles of Economics, (8th edition; London: Macmillan and Co., 1964), p. 173.

¹⁹Ibid., pp. 175-176.

²⁰Ibid., p. 179.

physical capital might be less than is socially desirable if all the social benefits from education are not already achieved at the investment maximizing level of education.

Summary

The writings of Smith and Mill are the cornerstones of the major theoretical developments of the concept of human capital. Education expenditures helped account for the differences in wages between skilled and unskilled workers. This difference in wages could be considered as a rate of return which when discounted could be compared with the rate of return from other investments.

The investment in education had as a component, opportunity costs, which had to be added to the monetary expenditures while the portion that applied to consumption had to be deducted.

Finally, there were external benefits from education and other forms of investment in man that society as a whole rather than the individual alone received.

An unused building stone of the theory concerning human capital was the definition of capital used by McCulloch, Fisher, and Walras. They included not only man's developed skills but also included him as a whole.

Walras and Von Thunen tried to show that looking at investment in man did not lessen man's humanity. On the contrary, it could improve not only his material welfare but also his moral welfare.

Sidgwick re-emphasized and clarified the nature of expenditures on man. In each there is a consumption and an investment component.

The last building stone of this period was contributed by Marshall as he expanded on what had only been alluded to earlier. He noted the importance to society investing in the education of the working classes, as the benefits to society exceed those to the individual who may not be able to afford the investment.

Empirical Techniques and Applications

Interest in human capital has led not only to the development of theoretical considerations, it has also led to the development of operational techniques and empirical studies. This section will examine the operational techniques developed and survey a cross-section of the types of empirical studies done up to the mid-nineteen-thirties when interest in human capital entered a period of stagnation effort faltered.

Before attempting this, though, it will be helpful to mention some of the reasons why scholars have done work in this area. This is important because one needs to keep in mind for what purpose a study is done if he is to realize the value and limitations of any given procedure or study. Some of the purposes authors gave for their studies include:

- (1) to demonstrate the power of a nation; (2) to determine the economic effects of education, health investment, and migration; (3) to propose tax schemes believed to be more equitable than existing ones; (4) to determine the total cost of war; (5) to awaken the

public to the need for life and health conservation and the significance of the economic life of an individual to his family and country; and (6) to aid courts and compensation boards in making fair decisions in cases dealing with compensation for personal injury and death.²¹

Empirical Techniques

Capitalize Earnings

Sir William Petty, among the first English economists to consider the value of human beings in monetary terms, was concerned about demonstrating the power of England, and the loss due to migration, war, and disease. Being of the mercantilist tradition, he felt that the power of England could be shown by its wealth. As he considered labor as the father of wealth, it was only natural that he considered humans as part of the wealth of the nation. In his essay "Political Arithmetik," 1661, he said:

I shall here set down the way of computing the value of every Head. . . . Suppose the People of England be Six Millions, suppose also that the Rent of the Lands be Eight Millions, and the profit of all the Personal Estate be Eight Millions more; it must needs follow, that the Labour of the People must have supplied the remaining Twenty Six Millions, the which multiplied by Twenty (the Mass of Mankind being worth Twenty Years purchase as well as the Land) makes Five Hundred and Twenty Millions, as the value of the whole People.²²

²¹Kiker, Op. cit., p. 481.

²²William Petty, The Economic Writings of Sir William Petty, Vol. I: (Edited by Charles Henry Hull; New York: Augustus M. Kelley, Bookseller, 1963), p. 267.

Petty was interested to note that not only the power of England but the monetary value of human life destroyed in war, from disease or from migration could be estimated " . . . , from whence we may learn to compute the loss we sustained by the Plague, by the Slaughter of Men in War and by the sending of them abroad."²³ This treatment of man as a major component of a nation's wealth had in a rough form one of the two basic empirical approaches used by scholars in their investigations of the monetary value of man and of investments made in him.

The approach used by Petty was one of capitalizing future earnings to determine man's economic value. It should be noticed that to determine the value of the labor force, he capitalized the wage bill to perpetuity at the going interest rate rather than for the average remaining life expectancy. Even so, this gave a fairly good estimate of labor's value considering the statistical information available to Petty.

The capitalized-earnings approach had its first scientific formulation in 1853 when William Farr considered human capital in the determination of what he considered a more equitable tax distribution. His procedure for estimating the capitalized value of earning capacity was "to calculate the present value of an individual's net future earnings, allowance being made for deaths in accordance with a life table."²⁴ The major improvements

²³Petty, Op. cit., p. 267.

²⁴Kiker, Op. cit., p. 482.

in method between Farr's and Petty's even though Farr still assumed full employment, is that Farr considered the cost of maintenance, i.e., net earnings rather than gross earnings, and a limited life expectance rather than in infinite one.

Working within the Petty-Farr framework, Dublin and Lotka put the capitalized earnings approach into firm mathematical notation in an attempt to estimate the proper amount of life insurance a man should carry.

"The result of their calculations was a formula:

$$V_0 = \sum_{x=0}^{\infty} v^x P_x (y_x E_x - C_x),$$

where V_0 is the value of the individual at birth; $v^x = (1 + i)^{-x}$ is the present value of \$1.00 due x years later; P_x is the probability at birth of an individual from age x to $x+1$; E_x is the proportion of individuals employed from age x to $x+1$; C_x is the cost of living for an individual from age x to $x+1$.²⁵

As they were concerned with determining the proper amount of life insurance a man should carry, the inclusion of C_x is correct. For most considerations such as optimum investment considerations, it should be deleted or adjusted because as it stands now it is a consumption component.

²⁵Kiker, Op. cit., p. 486.

Cost of Production

Besides the capitalized earnings approach the other basic approach used has been the cost of production procedure. This method was used by Ernest Engel in 1883 as he felt it was impossible to estimate the economic value of certain men like Newton or Benjamin Franklin.

Since, however, their rearing was a cost to their parents, it might be estimated and taken as a measure of their monetary value to society. This monetary value at age x may be determined from a formula:

$$C = e \{ 1 + x + k [x(x+1)/2] \}$$

where C is the total cost of producing a human being (neglecting interest, depreciation, and maintenance) through age x , c denotes costs incurred up to the point of birth, and k is the annual percentage increase in cost. The constant, c , was empirically found by Engel to be 100, 200 and 300 marks for the lower, middle, and upper German social classes, respectively. He observed k to be 0.1. This formula applies, however, only when $x \geq 26$. After age twenty-six the individual was assumed by Engel to be fully produced.²⁶

Unfortunately Engel's cost-of-production procedure does not give the economic value of man with perfect accuracy unless rather strenuous assumptions are met.²⁷

This method is not without value, however, for when it is used with the capitalized-earnings approach yields some interesting information. For example, after computing the investment in human capital with the cost-of-production approach, a rate of

²⁶ Ibid., p. 483.

²⁷ The conditions include: long-run equilibrium, full employment, constant returns to scale, perfect competition in the factor and product markets, equal training opportunities, perfect knowledge, economic returns as the sole cause for expenditures, and non-depreciability of man.

discount can be found which will equate the value from the cost-of production approach with the value from the capitalized value approach. The rate of return can be considered as the rate of return on the investment.

Empirical Studies

By the end of the 19th century empirical studies of the economic value of man and of the return to investment in human capital became quite frequent. In the section that follows a small sampling of these inquiries will be considered as scholarly examples of the early attempts made in this area.

An Estimate of the Stock of Human Capital

In 1891, J. Shield Nicholson attempted to estimate the stock of human capital in the United Kingdom as Petty had two hundred years earlier. Nicholson capitalized the wage bill, the earnings of management, capitalists and salaried government officials. Here he was assuming that everyone received compensation equal to the value of his marginal revenue product with constant returns to scale.

To determine the value of production of man per se, Nicholson used the cost-of-production procedure. He then added this to his capitalized value and concluded that the stock of human capital was five times the stock of conventional capital. This addition was unfortunate as it resulted in double counting since the economic value of man per se is what he is capable of

producing.

It is interesting to note that the capitalized earning values for labor was 24 billion£, for management 12 billion£, and for salaried officials£ 1 billion. Summing these we get the total capitalized value of man as£ 37 billion. This is drastically more than the 10 billion he got when he used the cost-of-production to determine the value of what he termed "domestic humanity."²⁸

The Human Cost of War

Grammond in his consideration of the cost of World War I was not only concerned with the material loss but also the loss of human life. In this regard he recognized the work done by Farr and Nicholson on the economic value of man in most of the warring countries. These estimates, which were based on the capitalized value procedure, were used to determine the losses in human capital due to the war. Forming these figures he estimated the losses in human capital for the first nine months of the war to be about 2.3 billion pounds or 1/4 of the cost of the war to that time.²⁹ As his estimates used the value of the average individual one might suspect this understated the true human losses if Barriol's estimates were fairly close.

²⁸ J. Shield Nicholson, Strikes and Social Problems, (London: Adams and Charles Black, 1950).

²⁹ Edgar Grammond, "The Cost of the War," Journal of the Royal Statistical Society, Vol. 78, (May, 1915), pp. 361-399.

M. Barriol's estimate of the economic value of the Frenchman was based on the capitalized value approach in which he assumed certain wage scales, adjusted for the rate of mortality and discounted at three percent. He then averaged the values by aggregation and division by the size of the population. Barriol then applied a coefficient of increase or reduction to allow for the difference between the standard of wages in France and other countries. He then multiplied these figures by reduction coefficients to take account of the lower wages of those women who worked.³⁰

Investment in Higher Education

Walsh, writing in 1935, preceded Schultz, Becker, and the others who are now interested in the economic importance of higher education. His article "Capital Concept Applied to Man," considered schooling which trained man for a professional career. "It attempts to determine whether money spent in acquiring such training is, in a strict sense, a capital investment made in a profit seeking, equalizing market."³¹

Walsh felt that education tended to be based mainly on profit-seeking calculations. This appeared to especially true after high school when the contributions of the state become less and the opportunity cost of staying in school increases.

³⁰Harold Boag, "Human Capital and the Cost of the War," Journal of Royal Statistical Society, Vol. 79, (January, 1916), pp. 7-17.

³¹J. R. Walsh, "Capital Concept Applied to Man," Quarterly Journal of Economics, Vol. 49, (Feb. 1935), p. 265.

In general, then, the more advanced and prolonged the education, the more exclusively vocational its purpose, the more probable it is that the guiding principle will be that of ordinary economic gain. If this is true, it would seem clear that the abilities acquired through strictly professional education resemble capital very closely. They are cultivated for gain, and the investment is made in a market where competition uses for savings will tend to force the returns on the cost of training to repay that cost with a profit, equal to that obtainable in other uses. Otherwise, the investment would take some other more profitable form.³²

To test these conclusions the discounted average earnings of men of various educational levels were computed as of the age in which earnings ordinarily begin. The costs of the various levels of training were estimated. A comparison was then made to see if the costs and the earnings tended to be equal.

In estimating the discounted earnings of the average worker in a given field and with a given education level, the expected annual earnings for age i was multiplied by the expectation that the person would still be alive at age i and this was then multiplied by the percent of people in that profession of age i who were employed. $i = (22, 23, 24, \dots, 74)$. These values were then discounted to the present year, $i = 22$, at a 4% per year.

The costs of education were based on six items:

- (1) Tuition, fees, and the like, paid to the school.
- (2) Board and room.
- (3) Equipment, such as books, and the like.
- (4) Personal expenses: clothes, recreation, travel.
- (5) Loss of that income which would, on the average, have been earned if the individual had not continued in school. From this amount was deducted the estimated

³²Ibid., p. 257.

average earnings of students during the school year and vacations.

(6) Annual cumulative interest at 4 percent on the sum of the above.³³ (34)

Before looking at the conclusion of Walsh's study, three points should be recognized. First, the data is based on average ability of the members of group and does not necessarily represent the income a person can expect from some given occupation. Second, and by far the more important consideration is that there are differences in ability between groups. Therefore, not all the differences in value are entirely due to the education received.

Such differences in earnings may be due to a number of causes: difference in ability, in age, in type of occupation, in place of work, in health and in luck.³⁵

The last of the three points is that Walsh was assuming that the supply and demand factors for each type of labor were in equilibrium.

That is, that he could use the wage structure in existence in computing his discounted earnings.

Table I gives a summary of the results of Walsh's study.

³³Ibid., p. 269.

³⁴ Walsh's inclusion of items (2) and (4) is highly debatable as these expenses would be approximately the same even if the person was not in school. If it is to be considered at all the net differences between these expenses for a student and non student should be used.

³⁵Ibid., p. 269.

TABLE I.--Comparison between discounted and cost values of special training

(1) Bank of Education	(2) Disc.Value over Elem. Education	(3) Cost Value of same	(4) Disc.Value over Elem. Education	(5) Cost Value of same	(6) Disc Value over B.A.	(7) Cost Value of same
1. H.S.	\$7,142	\$5,000	\$35,009			
2. B.A.			36,041	\$6,398		
3. M.A.			43,226	9,848		
4. Ph.D.			57,631	21,413		
5. B.B.A. or B.S.C.			37,690	12,963		
6. M.D.			67,784	22,622		
7. LL.B. (Lord)			83,386			
8. LL.B. (Land Grant)			42,101			
9. Engineers (Leven)			49,003			
10. Engineers (Land Grant)						
11. B.A. (Mich. Bus. Study)						
12. M.A. (Mich. Bus. Study)						

Walsh felt there was a persistent price disequilibrium between the discounted value of four years of college over a high school education, \$35,009, and the additional cost of the same, \$6,398. This he viewed, according to the teachings of Mill, as the result of a natural monopoly in which many people could not afford to compete.

Of those in professional training, the costs exceeded the values for the M.A., Ph.D. and M.D. The low additional pay received by those with an M.A. and Ph.D. over those with only a B.A., Walsh felt, was compensated for by the pleasant work and the social prestige. The M.D. was guided more by an altruistic humanitarian impulse rather than the profit motive.

The profits of those with LL.B. degrees, Walsh explained, as the result of non-long-run equilibrium wages which would in time probably become substantially lower.

This article by Walsh, even though it had some serious errors omitted by some of the more recent works, shows that the advanced techniques suggested in the writings of economists reviewed had been used in elaborate empirical studies almost thirty years before the renewed interest in the topic stimulated by Schultz.

Summary

Two different methods of measuring the value of human capital were developed by early economists. The first method, the capitalized value of future earnings approach, was developed by Petty and Farr. The second, the cost-of-production approach, was developed by Engcl.

It was seen that when the two approaches were equated a rate of return on the investment could be determined that could be compared with the rate of return from other types of investments.

In a study done by Nicholson in 1891 to estimate the value of the stock of human capital, both methods were used. Unfortunately instead of comparing the two results, Nicholson added them together which resulted in double counting.

Crammond used the capitalized values of the average individual as derived in Barriol's estimates to come to the conclusion that 1/4 of the cost of World War I was the loss of human productive capacity.

The last and most impressive empirical study done in this period was Walsh's study of the expense and returns from various levels and types of education. He compared the expense of investing in more schooling including the opportunity costs against the additional discounted return from that amount of additional schooling.

In general one can say that although there were errors made in the studies of this period, major advances in the theory and

empirical study of human capital had been achieved by the 1930's.

CHAPTER III

RECENT CONSIDERATIONS OF HUMAN CAPITAL

Introduction

Theoretical interest in investment in human capital entered the doldrums shortly after the turn of the century. Statistical studies such as those by Nicholson, Crammond, and Walsh continued but in view of the new sources of statistical information that were becoming available, the advances were slow. The reason for this is somewhat open to speculation but at least three arguments have been presented:

1. One argument goes back to Marshall. It will be recalled that Marshall was concerned about the proper (adequate) education of the young, but he was also interested in clarity of economic terminology. He therefore felt that the broader definitions of capital such as those used by Walras and Fisher, which included human capital, were undesirable.

The writings of Professor Fisher contain a masterly argument, rich in fertile suggestion, in favor of a comprehensive use of the term capital. Regarded from the abstract and mathematical point of view, his position is incontestable. But he seems to take too little account of the language of the market place.¹

.....

Any one who tries to express various meanings on complex things with a scanty vocabulary of fastened senses,

¹Marshall, Op. cit., p. 649.

will find that his style grows cumbersome without being accurate.²

This warning seems to have influenced the followers of Marshall to refrain from considering labor as capital and, therefore, stymied discussion of investment in human capital.

2. A second possible reason for the lack of interest in human capital is advanced by Schultz. He notes, as did Von Thunen and others, that talking about investment in man has moral overtones.

It is held by many to be degrading to man and morally wrong to look upon his education as a way of creating capital. To those who hold this view the very idea of human capital is repugnant, because for them education is basically cultural and not economic in its purpose, because, education serves to develop men and women an opportunity to acquire an understanding of the values they hold and an appreciation of what they mean to life. My reply to those who believe this is that an analysis that threatens education as one of the activities that may add to the stock of human capital in not way denies the validity of their position; my approach is not designed to show that these cultural purposes should not be, or are not being served by education. What is implied is that, in addition to achieving these cultural goals, some kinds of education may improve the capabilities of people as they work and manage their affairs and that these improvements may increase the national income.³

3. Another argument made by Schultz is:

Economists have found it all too convenient to think of labor as a homogeneous input free of any capital components. . . . One can always adjust and thus try to

²Marshall, Op. cit., p. 43.

³Theodore W. Schultz, "Capital Formation By Education," Journal of Political Economy, (Dec., 1960), pp. 572.

standardize the unit of labor, but there was no need of doing even that until fairly recently, because for a long time in Europe and in the United States, too, the statistics on hourly earnings and price were so shaky that no one could say for sure that real wages were rising.⁴

This sluggish condition changed sharply in the late 1950's with a significant increase in the theoretical discussions and empirical studies on a wide variety of forms of human capital.

The next section considers some of the major works that have led to the rekindling of interest in human capital. This will be followed by a review of the important points in the theoretical analysis of human capital by Becker and some of his critics. The last section of this chapter will then be devoted to an examination of several empirical studies done on investment in human capital.

The Rekindling of Interest in Human Capital

The works of three men, Mincer, Becker, and Schultz, seem to have been the driving force that rekindled interest in human capital. Mincer was the first of the three to publish a major article in this area so we shall turn to his study first.

Education's Influence on the Distribution of Income

Mincer's first effort in this area came in 1958⁵ when he

⁴Theodore W. Schultz, "Investment In Man: An Economist's View," The Social Service Review, Vol. 33, (June, 1959), p. 111.

⁵Jacob Mincer, "Investment in Human Capital and Personal Income Distribution," Journal of Political Economy, Vol. 66 (August, 1958) pp. 281-302.

presented a theoretical study of the influence of education on wage differentials. He worked through the implication of individual differences in investment in human capital on the distribution of income. In using the discounted value of future earnings in a method similar to Dublin and Lotke, he notes that:

the assumption of rational choice means an equalization of present values of life earnings at the time the choice is made . . . since the time spent in training constitutes a postponement of earnings to a later age.⁶

From this analysis he concluded that interoccupational differentials are a function of differences in training. Likewise, intra-occupational differences arise when the concept of investment in human capital is extended to include experience on the job. These conclusions were based on holding the other factors such as ability constant. When these other factors are allowed to vary, training and experience only partially explain the income differential.

By showing that the concept of investment in human capital could help explain such things as the distribution of income, Mincer gave modern economists one of many reasons for looking into the neglected concept of human capital.

⁶Ibid., p. 301.

Investment in College Education

Gary S. Becker raised more interest in this area when he wrote the article, "Underinvestment in College Education." His attention was directed to the question of underinvestment in college education because of the interest and concern that had developed over this issue due to the spectacular Soviet's accomplishments in economic growth and science.⁷

His analysis, which was based solely on monetary returns, was divided into the effect on the incomes of persons receiving education and the effect of the education on the incomes of others. After attempting to account for the differences in ability, race, sex, unemployment, and mortality, the returns were related to costs by a rate of return which equates the present value of returns and costs. Underinvestment in education would then be evidenced by a rate of return from education above the rate of return from alternative forms of investment opportunities, i.e., business investment.

Becker estimated the average return from business as being eight percent. Using the total expenses of college education as an estimate of the amount of investment in higher education, he estimated its rate of return at about nine percent. On this basis he felt that there was no marked underinvestment in college education.⁸

⁷Gary S. Becker, "Underinvestment in College Education?" American Economic Review, Vol. 50 (May, 1960) pp. 346-354.

⁸Ibid., p. 349.

In this estimate he gave no weight to monetary benefits occurring to others from such an investment. His reason was that there was high degree of ignorance about these benefits. This prevented any firm judgment about the adequacy of expenditures on college education.

Becker's conclusion that direct returns alone do not seem to justify increased college expenditures ran contrary to commonly held views of the return to education. The result was a series of commentaries and critiques written to evaluate and modify his conclusions.

The Value of The Concept of Human Capital

Although the articles by Mincer and Becker preceded the major works by Schultz in the field of investment in human capital, it is with his name that the revived interest in the topic is normally related. The reason for this is the excellent overall evaluation provided by Schultz of the potentialities and difficulties facing an economic approach to investment in man.

Schultz' first article on the subject, "Investment in Man: An Economists View," was published in June, 1959.⁹ In this and subsequent articles in the next few years, he stimulated interest and understanding in the field as he recognized the horizons that it could open, the paradoxes it could help solve, the areas in which it needed to be studied, and the policy

⁹Theodore W. Schultz, "Investment in Man: An Economist's View," Social Service Review, Vol. 33, (June, 1959) pp. 109-117.

changes called for by its social implications.

Schultz felt that the previous lack of interest was unfortunate as new interpretations and deeper understandings could be achieved in a whole set of questions when the role of investment in man is considered in the economic analysis. A few of these questions are: (1) How does one maximize the economic growth of a nation? The answer rests in the maximizing the allocation of resources. It only seems natural, therefore, to consider the costs and benefits from investments in education, health, migration, etc. (2) What causes the widely skewed income distribution? The article by Mincer mentioned above indicates that the education level is a major factor. (3) What are the causes of the poverty regions of the United States? It seems that one factor is the deplorable quality of education in these areas.

When farm people take nonfarm jobs they earn substantially less than industrial workers of the same race, age, and sex. Similarly nonwhite urban males earn much less than white males even after allowance is made for the effects of differences in unemployment, age, city size, and region. Because these differentials in earnings correspond closely to corresponding differentials in education, they strongly suggest that the one is a consequence of the other. . . . Workers in the South on the average earn appreciably less than in the North or West and they also have on the average less education. Most migratory farm workers earn very little indeed by comparison with other workers. Many of them have virtually no schooling, are in poor health, are unskilled, and have little ability to do useful work.¹⁰

(4) Why is the curve relating income to age steeper for skilled than for unskilled persons? Does it not seem that on-the-job

¹⁰Theodore W. Schultz, "Investment in Human Capital," American Economic Review, Vol. 51, (March, 1961) p. 3-4.

training is a partial explanation?

Schultz also noted that the study of human capital explains some of the paradoxes and puzzles of economic literature. We were taught that a country which amassed more reproducible capital to its land and labor would employ such capital in greater "depth" because of its growing abundance and cheapness. But apparently this is not what happens. On the contrary, the estimates now available show that less of such capital tends to be employed relative to income as economic growth proceeds. Are we to infer that the ratio of capital to income has no relevance in explaining either poverty or opulence?¹¹ It cannot, be inferred from these estimates that the stock of all capital has been decreasing relative to income. For example, "Goldsmith's ratio of national wealth to annual national income declined 25 percent between 1909 and 1949. . . . But all these estimates of capital exclude human capital represented by training, education, additional capabilities based on health and new knowledge."¹²

There is also, the Leontief paradox indicating that the United States exports mainly wage-goods and imports largely capital-intensive goods, contrary to what one might expect for a country with much capital and with very high real wages. But here, again, no account is taken of the human capital that is represented by the acquired skills and abilities of engineers, chemists, and other workers.¹³

¹¹Ibid., p. 5.

¹²Schultz, "Investment in Man: An Economist's View," p. 114.

¹³Ibid., p. 114.

Parallel questions are: (1) Why has the United States' economy been increasing at a much higher rate than the combined amount of land, man-hours worked, and the stock of reproducible capital used to produce the income? (2) Why were the judgments of the recovery rate of growth in Europe following World War II so much lower than the actual rates of recovery? (3) Why is it that poor countries can effectively absorb new capital only when it is added slowly and gradually? "This experience is at variance with the widely held impression that countries are poor fundamentally because they are starved for capital and that additional capital is truly the key to their more rapid economic growth."¹⁴

Schultz' hypothesis for these conditions is that economists have failed to consider the importance of human capital or at least some forms of human capital. Some of these major forms of human capital investment that Schultz felt needed to be considered included:

(1) health facilities and services, broadly conceived to include all expenditures that affect the life expectancy, strength and stamina, and vigor and vitality of a people; organized by firms; (3) formally organized education at the elementary, secondary, and higher levels; (4) migration of individuals and families to adjust to changing job opportunities.¹⁵

These areas of investment in human capital led Schultz to mention nine points whose social implications might require a new look at public policy decisions.

¹⁴Schultz, Ibid., p. 7.

¹⁵Ibid., p. 9

1. Our tax laws everywhere discriminate against human capital. . . . Human capital depreciates, becomes obsolete, and entails maintenance, our tax laws are all but blind on these matters.
2. Human capital deteriorates when it is idle because unemployment impairs the skills that workers have acquired.
3. There are many hindrances to the free choice of professions.
4. There are greater imperfections of the capital market in providing funds for investment in human beings than for investment in physical goods.
5. Internal migration, notably the movement of farm people into industry, made necessary by the dynamics of our economic progress, requires substantial investments.
6. The low earnings of particular people have long been a matter of public concern. . . . No small part of the low earnings of many Negroes, Puerto Ricans, Mexican nationals, indigenous migratory farm workers, poor farm people and some of our older workers, reflects the failure to have invested in their health and education.
7. Is there a substantial underinvestment in human beings other than in these depressed groups? This is an important question for economists. The evidence at hand is fragmentary.
8. Should the returns from public investment in human capital accrue to the individuals in whom it is made?
9. On assistance to underdeveloped countries to help them achieve economic growth, . . . investment in human beings is likely to be underrated and neglected.¹⁶

Disagreement on the Advisability of Using the Concept of Human Capital

While the articles by Mincer, Becker and Schultz opened the eyes of many economists to the potentials of increased understanding that could come from the consideration of human capital, some economists felt that it would be inadvisable to treat man as human capital. This is the point of view of Harry G. Shaffer

¹⁶Ibid., pp. 13-16.

from the University of Kansas.¹⁷ He cites three main reasons why he believes economics has little to gain and much to lose by the universal application of the capital concept to man.

First, investment in man is essentially different from investment in nonhuman capital. The difference arises largely from the fact that, as a general rule, at least part of any one direct expenditure for the improvement of man is not investment as the term is usually used.¹⁸

In other words, expenditures on man have inseparable parts of consumption and of investment. This makes cost approach techniques largely "guesstimates".

Second, in using the earnings approach *ceteris paribus* conditions do not really hold and, therefore, it is not known if an addition to income comes from education or from differences in intelligence, sex, race, health, etc.¹⁹

Finally, if consumption expenditure could be separated from investment in man, and if it were possible to compute the part of man's income that results from a given investment-in-man expenditure, it would in most instances still be illadvised -- from the point of view of social and economic welfare--to utilize the information obtained as the exclusive or even the primary basis for policy formation, public or private.²⁰

An example Shaffer uses to support this point of view are studies that:

¹⁷ Harry G. Shaffer, "Investment in Human Capital: Comment," American Economic Review, Vol. 51, (December, 1961) pp. 1026-1035.

¹⁸ Ibid., p. 1026.

¹⁹ Shaffer is really only pointing out some of the difficulties to be considered. It is how well these other variables are controlled that will determine the degree of confidence justified in the results achieved.

²⁰ Ibid., p. 1027.

clearly show the due to greater vocational opportunities, the income differential correlated with additional education is considerably higher for whites than for Negroes. Were we to agree that the government should treat expenditures for education as investment, could not a good case be made for the decrease, if not the discontinuation, of governmental subsidization of nonwhite students and consequently higher subsidization of the financially more remunerative white students?²¹

Schultz responded to this criticism in the following manner:

The principal source of Shaffer's confusion in discussing policy arises from his belief that, if it were to become known that particular forms of education pay in terms of increases in future earnings, policy decisions which took this fact into account would necessarily no longer take into account any of the other important contributions of education. People, including those who make policy decisions are simply not that monolithic in their evaluation of education.²²

Shaffer's negative comments are of value in reminding us that we could develop a warped sense of values if we looked upon investment in man from only a strictly economic perspective. But by realizing this possibility and consciously avoiding it, there are many benefits that can be made to the science of economics and to the welfare of man. Therefore, let us proceed with the theoretical contributions that come from the concept of human capital.

²¹Ibid., p. 1031.

²²Theodore W. Schultz, "Investment in Human Capital: Reply," American Economic Review, Vol. 51, (December, 1961), p. 1038.

Investment In Human Capital: A Theoretical Analysis²³

Becker's theoretical analysis is divided into four major parts: (1) different kinds of investments; (2) relation between earnings, costs and rates of return; (3) the incentive to invest; and (4) some of the effects of human capital.

In the first part on-the-job training receives major attention as it clearly illustrates the effect of human capital on earnings, employment, the connection between foregone and direct costs, and different ages is vividly brought out. This analysis develops a modified theory of firm behavior which includes the effect of the productive process itself on the worker productivity. The following section summarizes his development.

Different Kinds of Investment

On the Job

Workers can increase their productivity by learning new skills and perfecting old ones on the job, but this entails costs. The costs are the physical goods used and the production forgone in the training process. These costs would have to be covered by higher returns if they are to be profitable. In other words,

²³ Although this is an excellent theoretical treatment of investment in human capital, it is not a complete analysis of the subject. The argument is conducted entirely from the viewpoint of an individual investor, i.e., prices are taken as parameters. This avoids the question of how to measure changes in the capital stock and in its rate of return when relative prices change. (See M. W. Reder's review article on Becker, which is listed in the bibliography, for further information.)

$$\sum_{t=0}^{n-1} \frac{R_t}{(1+i)^{t+1}} = \sum_{t=0}^{n-1} \frac{E_t}{(1+i)^{t+1}}$$

where R_t is the receipts in time t , E_t is the expenses in time, t , and i is the going rate of interest.

When in a competitive labor market the on-the-job training is general, i.e., training that is useful in many firms, the market wage rates would increase by exactly the amount as the marginal product increases from training. Therefore, the firm would have no reason to provide training. In this case the trainee must be willing to pay for all the costs out of lower wages, remembering, of course, he receives all the benefits.²⁴

This explains the concave relation of earnings to age; that is the rate of increase in earnings is affected more at younger than at older ages as younger people are more likely to invest in themselves as they have more years in which to reap the benefit. "The combined effect of paying for and collecting the return from training . . . would be to make the age earnings curve of trained persons . . . steeper than that of untrained persons, the difference being greater the greater the cost of and return from the investment."²⁵

While there is some general training, most is specific training which increases the productivity in the firm that is

²⁴ In this form "a depreciation-type item is deducted, at least from the earnings due to on-the-job training, for the cost would be deducted during the training period.

²⁵ Gary S. Becker, "Investment in Human Capital: A Theoretical Analysis," Journal of Political Economy, Vol. 70, Supplement (Oct., 1962), p. 15.

providing the training. In this case the firm could "collect a return from such training in the form of larger profits resulting from higher productivity, and training would be provided whenever the return--discounted at the appropriate rate--was at least as large as the cost."²⁶ Another possibility is that the worker pay for the cost of the training and then be rewarded by higher future wages.

At any rate the willingness of the firm or individual to make this kind of investment depends on the rate of labor turn over. Assume, for example, that after a firm has invested in the training of its workers that the workers start changing employment. This might result in the firm considering past training as a fixed cost and thereby lead it to increase wages to maintain its workers and thereby save part of its investment. The higher wage for trained workers would increase the supply of trainees so that some of the training costs via lower training wages could be shifted to the workers. They then would receive the benefits of higher wages after the training period. In this case both sides would develop a vested interest in a low labor turnover.

Therefore, a rational firm tends to pay generally trained employees the same wage and specifically trained employees a higher wage than they could get elsewhere.

²⁶Ibid., p. 18.

Schooling

A second major area of investment in human capital is investment in formal education which has two cost components: direct costs and indirect costs. The direct costs for the student are tuition, fees, books and supplies, unusual transportation and lodging expenses, etc. The indirect cost for the student is the difference in income received while in school from what he could earn if he were free to work full time.

Schooling would have the same kind of implications as general on-the-job training. Thus schooling would steepen the age-earnings profile, mix together the income and capital accounts, introduce a negative relative between the permanent and current earnings of young persons and allow for depreciation on human capital.²⁷

Other Knowledge

Expenditures to gain additional knowledge about the job market can also be considered investment in human capital as it will be expanded until the expected rate of return is equal to that on our investments.

If workers paid costs and collected the return on investment in search would have the same implications about age-earnings profiles, depreciation, and the like as general on-the-job training and schooling, although it must be noted that the direct costs of search, like the direct costs of schooling, are usually added to consumption rather than deducted from earnings. If firms paid costs and collected the return, search would have the same implications as on-the-job specific training.²⁸

²⁷Ibid., p. 26.

²⁸Ibid., p. 27.

Productive Wage Increase

Improving of emotional and physical health will result in greater productivity and is thereby another form of investment in human capital. This improvement can come about by decreasing the death rate, improving the stamina and strength of the employees, or by improving the morale through changes in the working conditions.

With an imperfect capital market, private investment in health will rely heavily on earnings and other income as a major source of funds. "When a firm gives a productive wage increase--that is, an increase that raises productivity--'outside' investments are, as it were, converted into on-the-job investments." ²⁹ The way in which this wage increase can be spent varies so firms might be tempted to exert an influence of the spending by having company stores and services.

This might help explain the employer paternalism in underdeveloped countries where the firms often have monopolistic power in the labor market and receive most of the benefits from the increased productivity due to investment in health.

Relations Between Earnings, Costs, and Rates of Return

An internal rate of return can be defined as that rate which will discount a future earnings stream so that it becomes equal to the cost of the investment. The cost of an investment

²⁹ Ibid., p. 28.

in some period is the total forgone earnings and physical outlay made by choosing the activity that needs the investment over one that does not need it. When there are several periods of investment, then "total cost, defined simply as the sum of costs during each period, would equal the capitalized value of returns, the rate of capitalization being a weighted average of the rates on the individual investments."³⁰

The investment period of education can be measured by years of schooling, but the period of on-the-job training, the search for information, and other investments is not readily available. Happily, one need not know the investment period to estimate costs and returns, since all three can be simultaneously estimated from information on net earnings. If activity X were known to have no investment (a zero investment period) the amount invested in Y during any period would be defined by

$$C_j = X_j - Y_j + r \sum_{0}^{j-1} C_k \quad \text{all } j$$

and total costs by

$$C = \sum_{0}^{\infty} C_j \quad 31$$

where C_j is the foregone earnings in the j^{th} period; r is the internal rate of return, X_j is earnings from the activity not chosen in the j^{th} period; and Y_j is the earnings from the activity chosen in the j^{th} period.

This is saying investment occurs in Y whenever earnings there are below the sum of those in X and the potential income

³⁰Ibid., p. 33.

³¹Ibid., p. 35.

derived from prior investments.³²

The Incentive to Invest

In this section Becker shows that this interpretation of the factors which influence the amount and nature of investment in human resources can be powerful and simple tool capable of explaining a wide range of phenomena.

Number of Periods

"An increase in the life span of an activity would, other things being equal, increase the rate of return on the investment made in any period."³³ Accordingly younger people have a greater incentive to invest because they can collect the return over more years. This is true wherever the benefits of an investment could raise earnings for more periods than the individual has left to be employed. In this case the rate of return would decrease the older the person is.

The length of use of the investment is restricted not only by death, and retirement, but also by the switching of activities, i.e., women becoming housewives rather than being secretaries.

Wage Differentials and Secular Changes

It is the absolute, not the relative, income differences

³²This is a very abbreviated form of what Becker said in this section. For a fuller understanding of all the limitations and implications, see his book Human Capital.

³³Becker, "Investment in Human Capital: A Theoretical Analysis," p. 37.

which determine the internal rate of return. This is in contrast to occupational and educational wage differentials which are sometimes measured by relative wage differences. Now if technological

progress were uniform in all industries and neutral with respect to all factors, and if there were constant costs, initially all wages would rise by the same proportion and the prices of all goods, including the output of industries supplying the investment in human capital, would be unchanged. Since wage ratios would be unchanged, firms would have no incentive initially to alter their factor proportions. Wage differences, on the other hand, would rise at the same rate as wages, and since investment costs would be unchanged, there would be an incentive to invest more in human capital, and thus to increase the relative supply of skilled persons. The increased supply would in turn reduce the rate of increase of wage differences, and produce an absolute narrowing of wage ratios.³⁴

This implies that technological progress tends to favor skilled labor over unskilled labor; it tends to induce increased investment in human capital.

Risk, Liquidity, Capital Markets and Knowledge

Human capital is a very illiquid asset. As it cannot be sold, it is a rather poor collateral in loans and, therefore, it may be more difficult to get investment loans.³⁵

Complementing this problem is the uncertainty of the expected rate of return due to lack of knowledge of the future,

³⁴ Ibid., p. 40

³⁵ This depends somewhat on the age of the investor. A young person will have difficulty getting a loan for any type investment at a moderate rate unless outside collateral is available.

and of present abilities. Some of this lack of knowledge is impossible to gain; other takes time. "Since an investment in human capital is more costly to postpone, it would be made earlier and presumably with less knowledge than comparable non-human investments."³⁶ So financing may prove a more formidable obstacle to investors in human capital because they cannot postpone their investment as readily.

Some of the Effects of Human Capital:
Ability and the Distribution of Earnings

Intelligence tests do not reliably measure the talents required to succeed in the economic sphere as this requires a particular kind of personality, persistence, and intelligence. This makes it difficult to isolate the effect of greater ability from more education in determining the rate of return on an investment in human capital.

Since people with more ability, *ceteris paribus*, tend to get a higher return from investment in human capital, ability and investment tend to have a high positive correlation. The result is an income distribution that is strongly skewed towards those with greater ability.

With this understanding of some of the empirical implications of the theory of investment in human capital, let us turn to several of the empirical studies that have been done on the various areas of investment in human capital to see what

³⁶Ibid., p. 43.

conclusions have been determined.

Empirical Studies of Investment in Human Capital

In this section we will examine in detail studies on the investment in human capital in the areas of general education, specialized training, and health. As has been mentioned there are many other important areas of investment in human capital such as migration and knowledge of the market, but unfortunately very few studies have been published in these areas.

Investment in Education

This chapter, it will be recalled, began with a review of Becker's cost-benefit analysis of educational expenditures. To give a broader perspective of the empirical work done, two more studies will be discussed. The first, by Schultz, is an estimation of the capital formation by education. The second, by Morgan and David, analyzes the influence of education on income.

Capital Formation by Education

In an article written in 1960³⁷, Schultz estimated the change in capital formation from the various levels of education and compared these to the changes in other forms of capital formation. To do this he first estimated the cost of education; a major part of this was foregone earnings.

³⁷Theodore W. Schultz, "Capital Formation by Education," Journal of Political Economy, Vol. (December, 1960), pp. 571-583.

In estimating foregone earnings it was assumed that no earnings were foregone while the students were in elementary school. For higher levels,

the year 1949 was taken as a base year in determining the earnings per week of young people, both males and females, for each of four age groups. Students' foregone earnings were calculated on the assumption that, on the average, students forego 40 weeks of such earnings, and then expressed in earning equivalent weeks of workers in manufacturing in the United States. The results . . . indicate that high-school students forego the equivalent of about 11 weeks of such earnings. These 1949 earnings ratios were applied to particular years between 1900 and 1956; an adjustment was then made for unemployment.³⁸

The results are summarized in Table II.

TABLE II.--Annual earnings foregone by students, adjusted and not adjusted for unemployment, 1900-1965, in current prices.

Year	Average Weekly Earnings, All Manufacturing (Dollars)	Unadjusted (Dollars)	Adjusted for Unemployment (Dollars)	Unadjusted (Dollars)	Adjusted for Unemployment (Dollars)
		High School (2)	School (3)	College, (4)	University (5)
1900	8.37	92	84	209	192
1910	10.74	118	113	269	259
1910	26.12	287	275	653	626
1930	23.25	256	224	581	509
1940	25.20	277	236	630	537
1950	59.33	653	626	1,483	1,422
1956	80.13	881	855	2,003	1,943

³⁸ Ibid., p. 573.

These estimates are limited by the fact that: (1) summer work often receives a lower hourly wage; (2) those going to school probably have more ability than those who have dropped out; (3) some students work while going to school; (4) finding employment is more difficult for young people. The first two of these limitations tend to underestimate the foregone earnings while the last two tend to over estimate it.

To cover the total costs of education, it is necessary to also consider the cost of teacher, librarian, and school administrator services,

of the annual factor costs of maintaining and operating the school plant, and of depreciation and interest. It should not include expenditures to operate particular auxiliary enterprises, such as providing room and board for students, operating organized athletics or other non-educational activities. School expenditures for scholarships, fellowships and other financial aids to students should also be excluded, because they are in the nature of transfer payments; are the real costs involved in student time already fully covered by the opportunity-costs estimates.³⁹

Table III gives the summarized values of the foregone earnings, service costs, and total costs of education.

³⁹Ibid., p. 577.

TABLE III.--Annual costs of education (millions of dollars)

Year	<u>Elementary Education</u>		<u>Secondary Education</u>		Total	<u>Higher Education</u>		<u>Grand Total</u>	
	Outlay		Foregone Earnings			Outlay	Foregone Earnings	Total	
1900	233	19	59	81	40	46	90	404	
1910	450	50	124	180	81	92	182	812	
1920	967	215	688	937	184	374	595	2,499	
1930	1,947	741	1,075	1,830	535	560	1,151	4,968	
1940	1,810	1,145	1,676	2,905	742	802	1,624	6,339	
1950	4,219	2,286	4,006	6,492	2,128	3,781	6,287	14,998	
1956	7,853	4,031	6,584	10,944	3,500	5,821	9,903	28,700	

It can be seen that the foregone earnings is a major cost of education at both the high school and college level.

"Earnings foregone while attending high school were well over half the total costs in each of the years; they were 73% in 1900 and 60% in 1965."⁴⁰

While in college the foregone earnings averaged 50-60% of all costs.

In 1900 and 1910 these earnings were about half of all costs, rising to 63% in 1920 and then falling to 49% in 1930 and 1940. With inflation and full employment, they then rose to 60% and 59% in 1950 and 1956.⁴¹

.....
For all levels of education together, earnings foregone were 26% of total costs in 1900 and 43% in 1956.⁴¹

As far as total costs, Schultz found that, "between 1900 and 1956, the total resources committed to education in the United States rose about three and one-half times (1) relative to consumer income in dollars and (2) relative to the gross formation of physical capital in dollars."⁴² Between 1900 and 1956 the total costs of education have risen from 9 to 34 percent of the total entering into the formation of physical capital. Of this 34 percent, 9 percent was coming from elementary education, 13 percent from high school education, and 12 percent from higher education, and 12 percent from higher education.

⁴⁰Ibid., p. 577.

⁴¹Ibid., p. 577.

⁴²Ibid., pp. 577-578.

The Rate of Return from Education

The article, "Education and Income," by Dr. Morgan and Dr. David provides the second half of this discussion on investment in education. Whereas Schultz provided an estimate of the expenditures on education that might be considered as investment, Morgan and David analyze the monetary return that comes from more education.

To restrict their analysis to the benefits of education that can be measured by increased earning potential, they used hourly earnings rather than yearly earnings which is effected by the extra leisure that can be afforded by those with more education.

They used a multiple regression analysis in an attempt to isolate the influence of the effect of age and education from other variables such as: race, sex, estimates of ability and motivation, physical condition, mobility, parental education, and occupation.

After running the problem with a sample that included Negroes, women, and farmers, the problem was rerun without them to see if their belief that education had a more powerful influence on earnings on white, nonfarm males than on the nation as a whole. The beta coefficient⁴³ for age-education was found to increase from .234 to .279.⁴⁴

⁴³ A beta coefficient is a measure of the number of standard deviations the dependent variable moves for a movement of the independent variable of one standard deviation.

⁴⁴ James Morgan and Martin David, "Education and Income," QJE, Vol. 77, August 1963, pp. 430.

The implication is that education has greater influence on the incomes of white, nonfarm males.

The hourly earnings according to age and educational level are summarized in Table IV.

TABLE IV.--Hourly earnings, actual and adjusted by age and education (for all white, male, nonfarmer heads of spending units in the labor force who worked in 1956).¹⁰

Education	Age					
	18-24	25-34	35-44	45-54	55-64	65-74
1-8 grades actual	\$1.70	\$2.12	\$2.23	\$2.26	\$2.21	\$1.74
adjusted	1.85	2.26	2.58	2.59	2.61	2.04
9-11 grades actual	1.96	2.38	2.55	2.58	2.53	2.06
adjusted	2.10	2.51	2.71	2.72	2.74	2.17
12 grades actual	1.92	2.34	3.04	3.07	3.02	2.55
adjusted	1.99	2.40	2.90	2.91	2.93	2.36
12 grades and actual nonacademic	2.19	2.61	3.00	3.03	2.98	2.51
training adjusted	2.02	2.43	2.85	2.86	2.88	2.31
College, actual	2.30	2.72	3.12	3.15	3.10	2.64
no degree adjusted	2.32	2.73	2.99	3.00	3.02	2.45
College actual	2.71	3.13	3.90	3.93	3.88	3.41
bachelor's degree adjusted	2.46	2.87	3.66	3.67	3.69	3.12
College, actual	3.20	3.62	4.47	4.50	4.45	3.93
advanced degree adjusted	2.71	3.12	4.23	4.24	4.26	3.69

⁴⁵Ibid., p. 433..

Morgan and David estimated the lifetime earnings from Table IV. They assumed 2000 hours of work each year and then used a four percent rate to discount these values back to the age of fifteen.⁴⁶

The results of this estimation are given in Table V.

TABLE V.--Value at age fifteen of expected future earnings, discounted at 4 percent assuming 2000 hours of work per year to age sixty-five (for all white, male, nonfarmer heads of spending units).⁴⁷

Amount of education completed	At age fifteen	
	Using unadjusted earning rates	Earning rates adjusted for other factors.
0-8 grades	\$86,600	\$96,000
9-11 grades	91,100	96,950
12 grades	91,100	90,300
12 grades and nonacademic training	92,400	86,900
College, no degree	92,850	91,100
College, bachelor's degree	108,150	100,450
College, advanced degree	111,000	101,700

It should be noted that the advantage of getting a college diploma is \$17,050 gross, or \$10,150 adjusted. These values are affected greatly by the level of forgone earnings and the rate of discount. For example,

⁴⁶It should be noted that no adjustment is made for the probability of unemployment.

⁴⁷Ibid., p. 434.

if we ignore the period from fifteen to twenty-five years of age, the differences between a high school education and a college degree jump from \$17,050 to \$33,300 unadjusted, and from \$10,150 to \$25,500 adjusted. . . . The undiscounted differences between high school degree and college degree are over \$60,620 for the unadjusted earnings estimate, and \$54,680 using the earnings estimates adjusted for the effects of other factors.⁴⁸

In this kink of analysis made by Morgan and David, several qualifications need to be kept in mind. "First, data on earnings at a point in time are only rough indicators of future lifetime incomes. The increasing levels of monetary incomes underestimates the levels and differences that might exist in the future."⁴⁹ Second, the multiple regression analysis removes too much and tends to understate the effects of education. Third, education is not all of the same quality and therefore does not have the same return.⁵⁰ Finally, education also influences the probability of being employed which raises the economic return to education.

Investment in Technical Education

The article written by Jacob Mincer in 1962⁵¹ is a scholarly study from which to start a deeper analysis of investment in technical education. He divides his study of on-the job training into two parts: first, he estimates the amount of investment in

⁴⁸Ibid., pp. 434-435.

⁴⁹This is one of the reasons David and Morgan give for choosing a four percent rate of discount.

⁵⁰Ibid., p. 436.

⁵¹Jacob Mincer, "On-the-Job Training: Costs, Returns, and Some Implications," Journal of Political Economy, Vol. 70 Supplement, (October, 1962), pp. 56-79.

on-the-job training; second, he estimates the rate of return from some particular apprenticeship programs.

Estimates of Costs of On-the-job Training

Mincer based his estimate of the cost of training on the opportunity costs, lower wages of the trainees. This tends to understate the cost of training as it makes no allowance for the cost incurred by the business firm which is not passed on to the trainee via lower wages. He realized this limitation but felt it was necessary as there are no accounting measures provided that even vaguely approximated the firms training expenditures, let alone indicating that portion which the firm sustains.

In comparing these opportunity costs with those from formal education, several striking discoveries were made. (1) "The opportunity costs of on-the-job training per male are almost without exception somewhat higher than costs of a comparable increment of schooling."⁵² (2) There is a strong correlation, +.86, between having more schooling and having more training. (3) The aggregate annual investment in training for people with only elementary or high school education has been declining since 1948 while there has been a rapid increase in the college level training.

Table VI gives the aggregate opportunity costs of training at school and on-the-job for United States males during the years 1939, 1949, 1958.

⁵²Ibid., p. 59.

TABLE VI.--Aggregate annual investment in training at school and on-the-job, United States males, 1939,1949,1958, by level of schooling (In \$ Billions).⁵³

Educational Level	1939			1949			1958		
	School	Job	Total	School	Job	Total	School	Job	Total
Current Dollars									
College	1.1	1.0	2.1	3.8	4.3	8.1	8.7	8.7	17.4
High school	1.8	1.4	3.2	3.4	3.8	7.2	8.4	3.8	12.2
Elementary	.9	.6	1.5	2.1	.9	3.0	4.5	1.0	5.5
All levels	3.8	3.0	6.8	9.3	9.0	18.3	21.6	13.5	35.1
1954 Dollars									
College	2.1	1.9	4.0	4.3	4.7	9.0	8.1	8.1	16.2
High school	3.5	2.7	6.2	3.8	4.2	8.0	7.8	3.5	11.3
Elementary	1.9	1.1	2.8	2.4	1.0	3.4	4.2	.9	5.1
All levels	7.3	5.7	13.0	10.5	9.9	20.4	20.1	12.5	32.6

To get the total costs of on-the-job training, the training costs of women and of servicemen must be added. These were estimated at \$1.4 billion and \$1.6 billion, respectively. "Addition of the two items brings the figure up to \$16.5 billion, more than half the aggregate costs of schooling (males and females) in 1956."⁵⁴

⁵³Ibid., p. 57.

⁵⁴Ibid., p. 63.

Estimates of Rates of Return

Mincer, finding the necessary data available in the mining, printing, and building industries, estimated the rate of return on apprenticeship programs for each industry in 1949.

TABLE VII.--Rates of return on apprenticeship training, selected trades, 1949.⁵⁵

Trades	Assumptions about Alternative Income Streams		
	Operatives in Same Industries	Operatives with Highest Schooling	Assuming a 10 Per Cent Return on Additional Schooling
	(1)	(2)	(3)
Metal	16.4	10.4	9.5
Printing	16.0	12.6	9.0
Building	18.3	11.3	9.7

The rates of return on apprenticeship training were computed in three different ways, but were all based on the formula:

$$(1 + r)^n = 1 + \frac{k}{d} \quad 56$$

where r is the rate of return, n is the number of years of training, k is the higher wage received after the apprenticeship program, and d is the opportunity cost of receiving a lower wage scale in apprenticeship than one could get as an operative.

⁵⁵Ibid., p. 64.

⁵⁶Ibid., p. 64.

The difference in the three methods had to do with estimates of d . In column (1) the apprentice's wage is compared with the wage of operatives in his own industry. But, as the apprentice averages two-three years more schooling than does the average operative, the rate of return is over estimated.

In column (2) " d was computed from a comparison of wages of apprentices with wages of operatives whose schooling levels are closer to levels of apprentices, regardless of industry attachment."⁵⁷

In column (3) the opportunity cost of the additional years of schooling the apprentices had over the operatives was added into d before determining the rate of return on the apprenticeship program.

A Case Study

A more recent study done on the costs and benefits from technical training was published in 1966.⁵⁸ This study, conducted by Adger Carroll and Loren Ihnen from North Carolina State University, was conducted for the purpose of measuring costs and returns of human capital created by investments in two years of post high school, technical education.

⁵⁷ Ibid., p. 65.

⁵⁸ Adger B. Carroll and Loren A. Ihnen, Costs and Returns of Technical Education: A Pilot Study, U.S. Department of Labor, Washington 25, D.C. July, 1966.

The study design was focused on three of the major problems in measuring the income effects of education: (1) separation of property income and labor earnings, (2) measurement of the income effects of technical education net of the income effects of other characteristics which are correlated with level of education, and (3) treatment of direct nonmonetary costs and returns of education.⁵⁹

The data came from 45 graduates of Gaston Technical Institute and from a control group of 45 high school graduates. The high school and Gaston graduates were selected in pairs so the members of each pair were high school classmates, graduating in the same year with very similar high school academic records. All were in good health and had had no post high school training other than the two years at Gaston Technical Institute.

A multiple regression analysis was used to further isolate the influences of other variables on the relative incomes.⁶⁰ Each variable was considered statistically significant and 55 percent of the variation in income was accounted for by regression.

The estimated average total cost to society for the two years of training was \$7,425 per student. Of this 70 percent or \$5,197 was estimated as the opportunity cost; \$770 was the additional private cost; and the state paid the remaining \$1,458.

⁵⁹ Ibid., p.1.

⁶⁰ Variables used were: technical education, high school grade average, age-experience, mother's education, residence during high school, military service, migration from home community, size of high school class, and two trend variables.

The monetary returns on investments in technical education began to accrue to Gaston Tech graduates during the first year after completion of technical schooling. The average annual income from investment in technical education increased from \$553 in the first year after schooling to \$1,036 in the fourth post-graduate year. Total return per student for the first four years after graduation amounted to 65 percent of the average private investment.

The estimated social rate of return on investments in technical education was 16.5 percent and the private rate 22 percent, assuming that per capita real earnings would increase over time at the rate of 2 percent per annum. When zero growth in the income advantage of Gaston Tech graduates was assumed, the estimated social rate of return was reduced to 11.7 percent and the private rate to 16.9 percent.⁶¹

Other benefits not included in this high rate of return include the external benefits to others, the psychic benefits, and fringe benefits which could be measured if adequate care is taken in handling the data.⁶²

Even so, Carroll and Ihnen did not feel that their study could be used as a basis for inferring that there has been or is underinvestment in technical education. Their reasoning was based on two facts. First, the study was a pilot effort covering a group of graduates from a single technical school. Second, graduates studied were the first class to graduate from a technical institution in North Carolina. They, therefore, might have faced less competition than in other states or later classes from Gaston Tech.

⁶¹Carroll and Ihnen, Costs and Returns of Technical Education: A Pilot Study, pp. 2-3.

⁶²Carroll and Ihnen examined it only close enough to see that it could be important.

Investment in Health

Problems of Analysis

The article "Health As An Investment"⁶³ by Selma J. Mushkin is an excellent article for understanding characteristics and difficulties of the measure of investment in health. It considers not only the similarities and differences between investment in education and health but also the measurement of capital formation through health care.

The interrelations noted between health and education include: (1) the dependence of some health programs upon education in personal hygiene and sanitation; (2) good health influences the capacity to learn; (3) lengthening of life through improved health also increases the rate of return on other investments in man; (4) like education, there are external benefits to investment, i.e., curative health services help prevent the spread of disease; (5) both are largely financed out of current consumption funds rather than investment funds. They, thereby, make positive net contributions to economic growth.

The differences between investment in education and investment in health indicate the necessity for different approaches to the measurement of human capital. These major differences are: (1) Health programs increase the numbers in the working force as well as the quality of labor's produce. Measurements need to include quantity as well as quality;

⁶³Selma J. Mushkin, "Health as an Investment," Journal of Political Economy, Vol. 70 Supplement, (October, 1962), pp. 129-157.

(2) Units of quality change through human capital formation by health programs cannot be defined as tidily as units of education embodied in the labor force. There is no quality unit comparable to that of the number of years of schooling, devised by Schultz as a measure of educational stock in the labor force. . . . It is difficult to disentangle the effects on the health status of the population that are attributable to health programs from those attributable to better nutrition, better housing, better working conditions, and high incomes;⁶⁴

(3) There are no ready indexes of the differences in income associated with graduations in health. There are only estimates of the time lost due to sickness, injury, and death and market evaluations of these losses. These estimates show no return from the investment in the man who would have been capable of working anyway but is now more productive.

Measurement of the Capital Formation in Health

The second major section of Mushkin's article measures the capital formation and return from health care. He points out, again, that the value of this stock of human capital can be figured either by the cost of production approach or by discounted value of the future earnings generated through the health programs. While the cost of the health and medical services up to the age eighteen can easily be estimated at slightly more than \$1,000 in 1957-58 prices,⁶⁵ the discounting earnings approach is needed for a cost-benefit analysis.

⁶⁴Ibid., p. 133.

⁶⁵Ibid., p. 136.

In estimating the value of increased earnings it is necessary to estimate the gain in productive work time and to assign a monetary value to the output that this added work represents. Several assumptions are made about the effect of health improvement on the gain in productive work time. First it is assumed "that if it were not for the disease those persons in the productive age groups stricken by the disease would have been working."⁶⁶ A second assumption is that persons who die from, or are disabled by, the disease would otherwise be in good health. The result of the disregard of the presence of multiple diseases overestimates the gains from the eradication or control of any single disease.

In estimates of gains from prevention or cure caused by a particular disease, deaths from multiple causes may need to be treated differently from those caused by the disease in question alone. Disability caused by sickness may be partial or long term.⁶⁷

There is also the problem of measuring the impact of diseases which cause disability or loss of working efficiency. What is needed is the formulation of a standard of output in the absence of the disease, from which shortcomings may be measured.⁶⁸

With these limitations in mind let us turn to a later article by Mushkin and Weisbrod, "Investment in Health:

⁶⁶Ibid., p. 138.

⁶⁷Ibid., p. 139.

⁶⁸Ibid.

Lifetime Health Expenditures on the 1960 Work Force."⁶⁹

The definition of health expenditures used included both public and private outlays on only the traditional health services: physician services, hospital care, dental services, drugs, and such public health expenditures as those on environmental health, medical research, and sanitation.

The aim of the study was to compare the expenditure on health services of persons in the 1960 labor force with return from the increased productivity due to these expenditures.

Taking workers at every age level private expenditures were traced back through the years to birth. Statistical estimates of the average expenditures per year for each age group were made for the years 1928-31, 1952-53, and 1957-58. Extrapolation from these years were made for the following intervals: 1890-1943, 1942-1956, and 1956-1960.

The expenditures were then put in 1960 prices and the sum of expenditures of each age level was added from the year of birth to 1960. This value was multiplied by the number of persons of that age group in the labor force. Summing over all age groups gave a total value of \$162 billion to the private health stock in the 1960 work force. This was equivalent to \$2,426 per worker.

To determine the public investment in the health of labor force, it was necessary to estimate what portion of the

⁶⁹Selma J. Mushkin and B. A. Weisbrod, "Investment in Health: Lifetime Health Expenditures on the 1960 Work Force," *Kyklos*, Vol. 16., (fase. 4, 1963) pp. 583-597.

population in the years 1890-1960 was composed by those who were still in the active labor force in 1960. These percentages were multiplied by the public health expenditure for the corresponding year and adjusted to the 1960 price level.⁷⁰

TABLE VIII.--Total health program stock 1960 work force (In Billions).

	Current Dollars \$	1960 Dollars \$
Total	132.5	203.9
Private	104.8	161.9
Public.	27.7	42.0

The measured total health expenditure in the 1960 work force is seen to be almost \$204 billion in 1960 prices. This may be compared with the estimated \$535 billion of total educational expenditures embodied in the 1957 labor force. Thus, about 38 cents of health resources have been devoted to the labor force for each \$1 of educational resources. The size of the total health expenditure, which we are calling a health stock--a form of human capital--may also be compared with the total stock of reproducible, tangible (non-human) wealth. Doing so, we find that the \$204 billion health stock is the equivalent of 16 percent of the \$1,270 billion of reproducible tangible assets in 1957.⁷¹

Mushkin and Weisbrod noted that the expenditures on health investment per worker had been growing. Between 1930-1957/58 expenditures increased by 100 percent even after adjustment

⁷⁰This resulted in an upward bias as a relatively large share of public expenditures was for persons, not in the work force such as older persons, persons with terminal illness, or for persons with mental illness.

⁷¹Ibid., p. 594.

for the change in level of medical care prices.

While the health stock per capita was increasing 100 percent in constant prices between 1930 and 1957, the stock of education per capita was increasing less than 85 percent, and the stock of reproducible non-human wealth per capita was increasing 24 percent, also in constant prices.⁷²

The Rate of Return From Health Investments

In another study, "Alcoholism and the Economic Value of a Man,"⁷³ A. G. Holtman developed a cost-benefit analysis to show that an increase in the treatment of alcoholism can be defended on economic grounds as well as on ethical grounds. Although there are many costs associated with alcoholism, the only one he considered in this analysis was the financial cost associated with the premature death of alcoholics.

The general formula used for calculating the present value of the potential loss of future earnings due to alcoholism is:

$$V_a = \sum_{n=a}^{\infty} \frac{Y_n (p_{a1}^n - p_{a2}^n)}{(1+r)^{n-a}}$$

In the formula V_a is the present value of the loss of earnings due to a decrease in life expectancy attributable to alcoholism; p_1^n is the probability that an alcoholic age a will live to age n ; Y_n is the alcoholic earnings at age n ; p_{a2}^n is the probability that an abstainer of age a will live to age n ; r is the rate of interest.⁷⁴

In order to estimate the earnings of an alcoholic,

⁷²Ibid., p. 596.

⁷³Alphonse G. Holtman, "Alcoholism and Economic Value of Man," Review of Social Economy, Vol. 23, (Sept., 1965), pp. 143-53.

⁷⁴Ibid., p. 145.

estimates of the median earnings for full-time male workers, in 1951 were used to estimate the average earnings of an alcoholic at each age level. These values were then multiplied by the probability of employment for each age. The validity of this value was based on recent studies showing that the occupational structure of cured alcoholics tended to equal or be above that of the general population.

The losses of the future income streams due to the death of an alcoholic was discounted at five percent, Otto Eckstein's estimate of the social cost of government investment, and then the problem was reworked using a 10 percent rate of discount, i.e., the estimate of the average rate of return on private capital.

With the five percent rate of discount, the average loss from excessive mortality among among 1950 male alcoholics was approximately \$4,188.⁷⁵ At a 10 percent rate the loss would be \$2,166 per alcoholic.

The cost of treating alcoholics at an alcoholic clinic in St. Louis, Missouri, was \$428 per case. The average loss of wages during the period of treatment was \$121. The total cost of treating an alcoholic was then estimated as \$549. Using the ratio \$549/\$4188 as the best cost-benefit ratio, Holtman concluded that if the percentage of successfully treated

⁷⁵Ibid., p. 150.

alcoholics was over 13 percent, the investment in rehabilitation was economical. He felt this was probably the case as "there are obviously other benefits from treating alcoholics and since some clinics in Connecticut report as high as 1/3 of the cases as having been successfully treated."⁷⁶

⁷⁶Ibid., p. 152.

CHAPTER IV

SUMMARY

Chapter II

In the second chapter we saw that the concept of human capital made a strong advance under the guidance of leading economists such as Petty, Smith, Mill, Walras, Fisher, and Marshall. In this early period all the ground work was done for a well developed addition to economic theory and econometric study. For not only was human capital considered in the writings of many early economists, but the basic empirical techniques used today were developed by Petty, Farr, and Engel. Others considered some of the empirical problems to be faced, while others such as Nicholson, Crammond, and Walsh, ventured empirical estimates of the value of man or the rate of return from investing in education.

After this advance interest seemed to stagnate for a period of about twenty years from the late 1930's until the late 1950's.

Chapter III

In chapter three the major points brought forth can be divided into four areas: (1) the value of studying human capital as a component of economic analysis; (2) elements of theoretical analysis; (3) empirical difficulties; and (4) empirical findings.

We will review briefly some of the high-lights of each area in the order above.

The Value of Studying Human Capital

Theodore W. Schultz more than any other economist lead to the rekindling of interest in human capital by showing the benefits the field of economics could gain by incorporating the study of human capital into its theoretical and empirical analyses. Some of the ways in which investment in human capital, i.e., education, health, migration, and knowledge of the market, could influence the understanding of economics are listed below:

1. Increasing the investment in human capital tends to raise one's wage to cover the cost of the investment. This helps explain the wage differential between individuals.
2. The fact that more investment in education is normally associated with people who have greater ability results in a skewed distribution of incomes as each characteristic by itself causes income to generally be higher.
3. Any study of how to maximize growth requires consideration of all the component factors which includes the quality of the human labor force.
4. The fact that physical capital is used in relation to human capital explains why there is a limit to the rate at which poorer countries can effectively absorb physical capital.
5. The large amount of human capital might be a partial

explanation for the Leontief Paradox.

6. Although some people have felt that it is morally objectionable to consider humans as a form of capital, it is now generally felt that the study of human capital can be of benefit to man's material and social well-being.

The Theoretical Analysis

The theoretical analysis presented by Gary S. Becker is one of the best of those which concentrate on the impact of investment in human capital on the actions of the firm and the individual. Some of his major points included:

1. It would not be in the interest of a firm to invest in general training unless they were assured that the trainee would remain with the firm for a given period of time.
2. Both sides will normally share the investment in specific training which will result in them gaining a vested interest in low labor turn over.
3. The problems of firms investing in the health of their employees helps explain the paternalism of the monopolistic firms in underdeveloped countries.
4. Investment in human capital tends to occur in the earlier years of life as there are then more years left during which the benefits can accrue.
5. Even neutral technology increases the incentive to invest in human capital.

Some Empirical Difficulties

In trying to estimate the stock of human capital and the rate of return on its investment, several major problems unique to the study of human capital were encountered. These include the following:

1. Most of the expenditures which have elements considered as investment in human capital also have consumption elements. It is very difficult to estimate the proportion of each and it generally has not been attempted.
2. It is difficult to isolate the influence of other factors such as ability when determining the influence of the human capital factor. This is true even with multiple regression analysis as it is sometimes difficult to estimate the magnitude of these factors.
3. Adequate indexes of the gradations of health have not yet been developed.
4. Besides the monetary benefits that are derived from a given level of investment there are also non-monetary benefits that cannot be measured in determining the rate of return on the investment.
5. There are also external benefits accruing to others that have not yet been determined.
6. Rough estimates of fringe benefits have been estimated in a few cases, but it requires additional data.

Some Empirical Findings

Some of the recent studies on the amount of investment in human capital and on its rate of return have come up with some interesting estimates that are worth keeping in mind.

1. The total stock of health capital is estimated at \$204 billion in 1960 which was equal to 16 percent of the reproducible tangible assets in 1957. This compares to the \$535 billion of education invested in the 1957 labor force.
2. In recent years the stock of human capital invested in health and education has risen three to four times faster than the stock on non-human capital.
3. The investment in on-the-job training was about \$165 billion in 1958 which was about one half of the amount spent on general schooling in that year.
4. Foregone earnings seen to be a major portion of the cost of education. They range around 60 percent of the total costs of education at both the high school and the college level.
5. Surprisingly, opportunity costs appear to be even higher with on-the-job training than with a comparable increment of schooling.

General Comments

As intensive empirical studies of investment in the various forms of human capital and their rates of return are only a recent phenomenon, many areas of study, i.e., health, on-the-job training, and migration, are still in an embryonic stage of

development. Only a few good estimates have been computed and many empirical problems need additional research so that better estimates can be made. But with many more studies now in the research process, it appears that continued advances will be made.

Amid this general optimism it is wise to keep in mind the word of caution made by Shaffer. Remember that the sole determinant of investment in man should not be the rate of return that can be received. If this is kept in mind and the knowledge of human capital gained is properly used, the results of the future studies can be significant value to the improvement of man's material well-being without or possibly improving his social welfare.

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HUMAN CAPITAL: A
REVIEW OF THE LITERATURE

by

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AN ABSTRACT OF A MASTER'S REPORT
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Literature in the American journals on human capital has been very much in vogue in recent years. The interest that has been shown has led to theoretical analyses and empirical studies on a wide range of related topics. The theoretical analyses have pointed out the fuller interpretation of economic activity that is possible from including the concept of human capital into the theoretical analysis. The empirical studies have attempted to estimate the stock and the rate of return the various forms of human capital.

As it appears that these efforts had and will continue to have significant influence on the theoretical and empirical nature of economics, the general objective of this report was to understand the nature and direction this influence has been taking. More specifically, it was hoped that an enlightenment of the advance made in theoretical analysis, an insight into the problems of empirical estimation, and an appreciation of the results obtained would be achieved. To achieve these goals the report first analyzed the historical interest in human capital.

It was found that economists as far back as Sir William Petty and Adam Smith had included the concept of human capital in their economic writings. They and a number of economists who followed them in the 19th century say the importance and some of the effects of investing in human capital. In particular their attention was drawn to the influence of education on a worker's wages and productivity.

During this same general period two general empirical approaches to estimate the stock of human capital were developed. Farr formulized the discounted earnings approach, which had first been used by Petty. This technique gave a value to the stock of human capital equal to the discounted value of future earnings stream that was generated by the investment in man. The other approach, which estimated the cost-of-production, was developed by Engel. With this technique all the expenditures on man that increased his productivity and, thereby, could be considered a form of investment in human capital invested in man.

Both of these techniques were used during the late 19th and early 10th centuries to estimate the value of man and to determine the costs and benefits from various levels of education. In these studies it was found that a high degree of sophistication had been achieved by the late 1930's.

With this background the paper then turned to the literature written on the subject within the last ten years. In this period of renewed interest in human capital Theodore W. Schultz made major contributions. He rekindled interest by very effectively presenting the reasons for studying the influence of investment in human capital. He then went on to make pilot study estimates on the size and impact of the investment in education in the United States. He did not work alone, however. His efforts were supported by the efforts of others including Gary Becker and Jacob Mincer.

It was Becker's theoretical analysis of human capital that was used as an example of the incorporation of the concept of human capital into a theoretical analysis. In this analysis was studied: the influence on the economic behavior of the individual and the firm; the problems of empirical estimation; and the theoretical and empirical characteristics of each form of human capital.

The final section of the report was directed to an analysis of several of the recent empirical studies to see what kind of results could be achieved in the face of the various empirical complications that must be faced. The study areas included were investment in general education, technical education, and health. Although many of the results varied, one common characteristic impressed the author. It was that the magnitude of investment in human capital in relation to tangible reproducible wealth and the fact that its rate of growth was about three to four times faster than the rate of growth of tangible reproducible wealth.

Through this diversified approach to the subject of human capital it was felt that a maximum over-all understanding of the subject could be achieved. It has tried not to concentrate in any area but, instead, to provide the background needed for more detailed study of specific aspects of human capital as might become desirable.